

Beam developments, Nanolab and target production

Sebastian ROTHE
EN-STI-RBS



ENGINEERING
DEPARTMENT

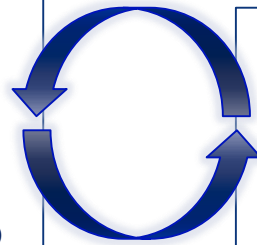
Target and ion Source Development (TISD) mandate



J.Ballof Y.Martinez T.Stora F.Boix Pamies S.Rothe J.Ramos

Providing a large choice of **intense** and **pure** radioactive beams
Constant development required to keep ISOLDE at the forefront of RIB facilities

- target and ion source units
- target materials
- beam interactions (p2n converter)
- ion source design / mode of operation shared with ISBM group



- yield & release study
- ion source efficiency measurements
- prototype tests

Sharing same resources as the ISOLDE physics program

- WORKSHOP: target unit production
- OFFLINE: target quality control
- ISOLDE: beamtime

Outline

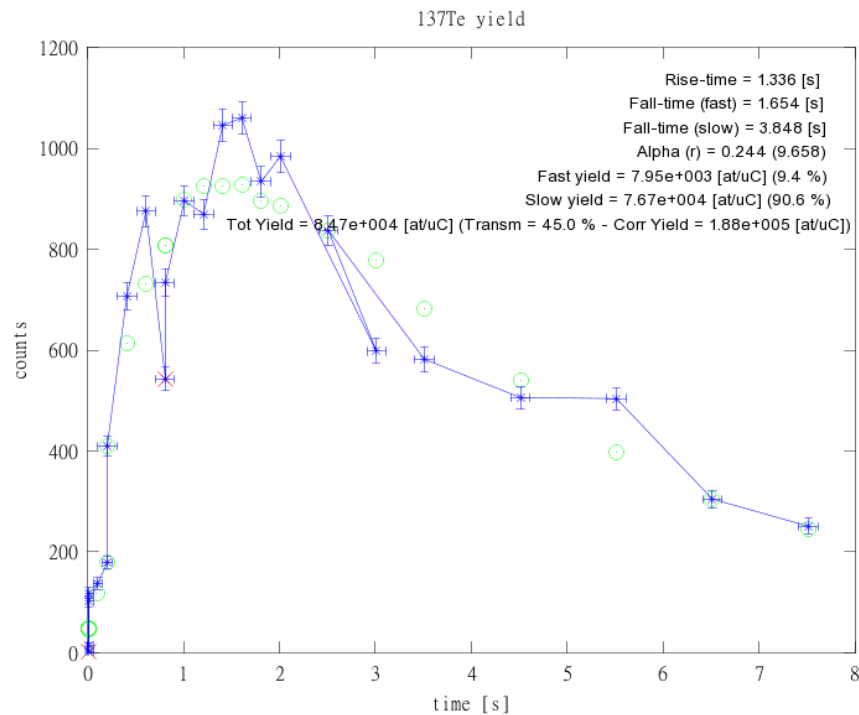
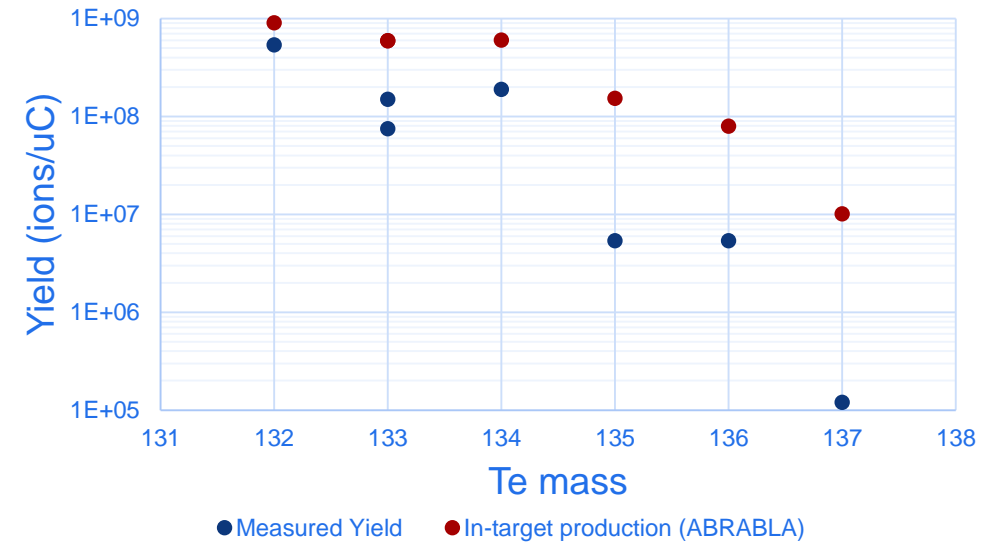
- Beam developments
 - LIEBE tests
 - Ion Source teststand
 - p2n Converter
- Nanolab
- Target Production
 - Target schedule 2017
 - Documentation

Expected TISD @ ISOLDE as presented to GUI

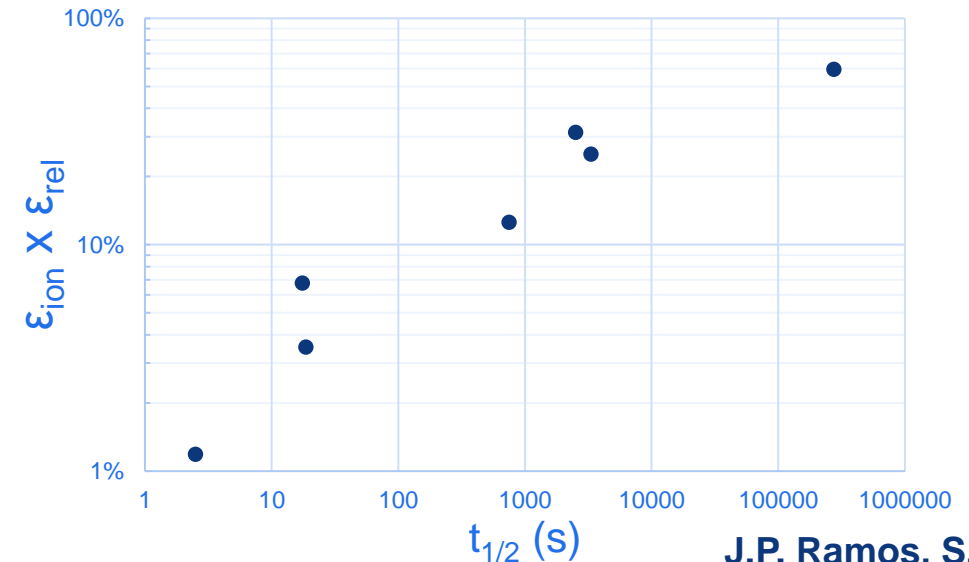
- Sc: Ti foils (CF4, RILIS)
- Te: yields with RILIS
- M(CO)_x formation @ MEDICIS irradiation point
- ThO felt + Negative ion source
- LIEBE @ GPS-online
- STAGISO beam test
- Si from UCx
- TiC-CNT (pending safety clearance)

Te yield measurements

A (Te)	t1/2	Te Yield	Cs yield	t1/2	A (Cs)
132	76.3	5.40E+08		6.47 d	132
133	12.5 m	7.50E+07		stable	133
133m	55.4 m	1.50E+08		stable	133
134	41.8 m	1.90E+08	1.10E+09	2.90 h	134m
135	18.6 s	5.40E+06	5.50E+08	53 m	135m
136	17.5 s	5.40E+06	5.30E+08	19 s	136m
137	2.5 s	1.20E+05		30.17 y	137

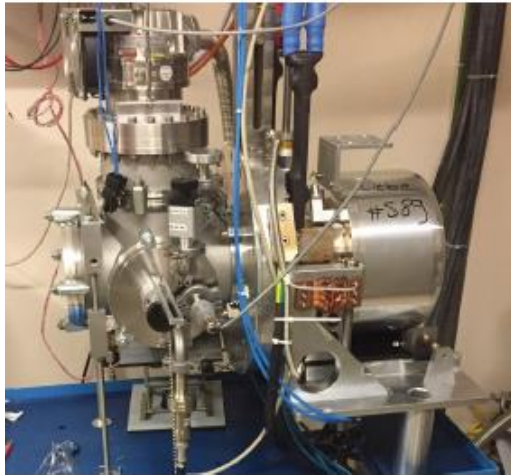


Total efficiency = Ionization efficiency x release efficiency

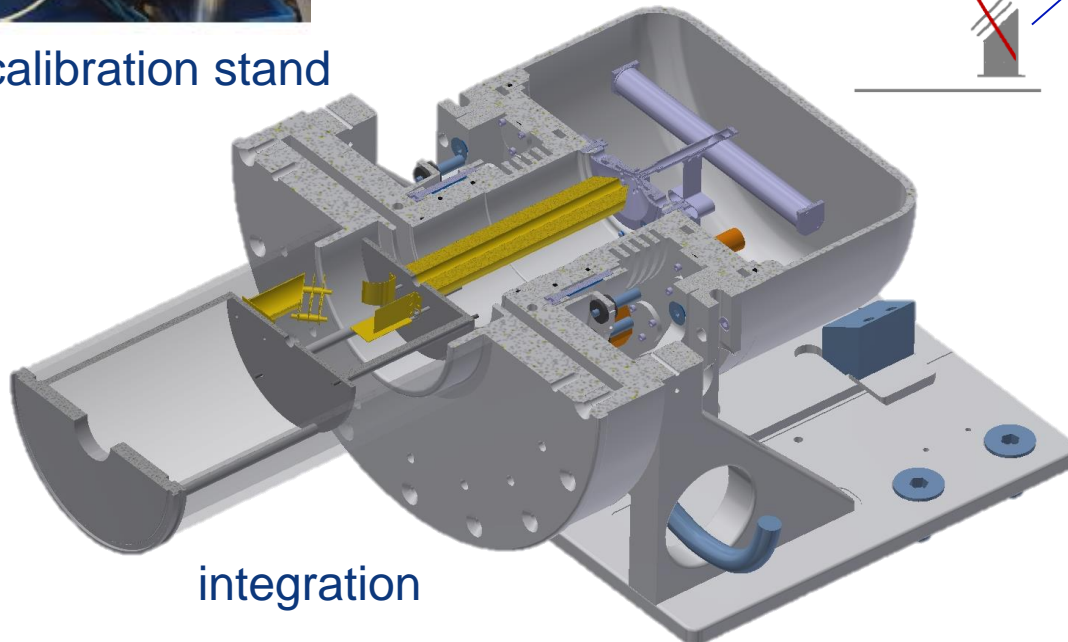
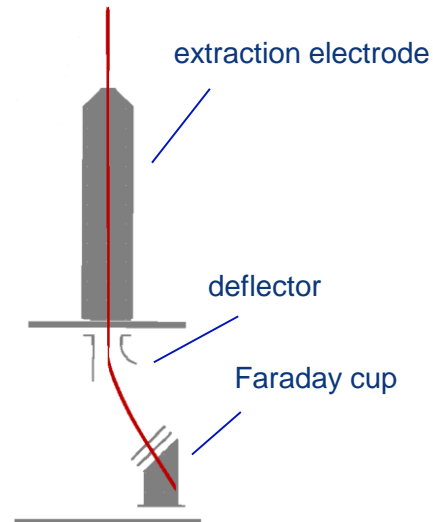


J.P. Ramos, S. Rothe, et al.

Dedicated test stand for ion source development



ISOLDE calibration stand



integration

Main features:

- ion beam extraction and detection
- residual gas analyzer (RGA)
- automated control and data recording

First application:

- **negative ion source development**
- investigation of source poisoning and regeneration

Future plans:

- long-term performance studies
- thermal stress tests
- destructive tests -> operational limits & failure mode analysis

David Leimbach

LIEBE Project

Present activities

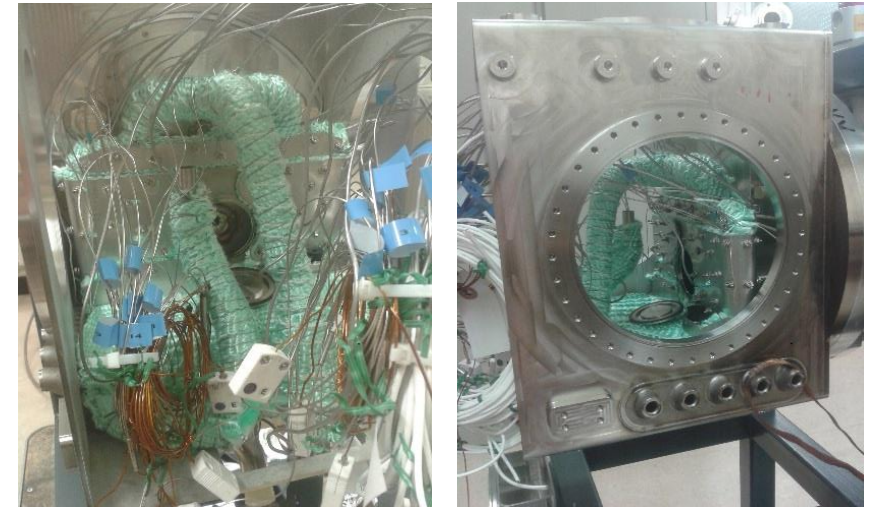
Description

Schedule

<p>HEX test</p>	<p>Experimentally confirm the power extracted by the heat exchanger.</p>	<p>Under preparation, starting 2nd week of July.</p>
<p>Diffusion chamber vacuum test</p>	<p>Test to confirm good enclosement of the chamber.</p>	<p>Ongoing: Difficulties due to the geometry of the target.</p>
<p>Pump vibration tests at IPUL</p>		<p>Ongoing: finishing by end of July</p>



Image of the installation to test the HEX



Actual state of the LIEBE target ongoing vacuum tests

Slide curtesy of Ferran Boix Pamies

LIEBE Project

Future activities

Description

Schedule

Task resume and total estimated duration of the project

Assembly	<ul style="list-style-type: none"> • Front wall • Lateral and top flanges • HEX external connections • Pump channel and collar • LBE deposit • Heating elements 	Starting after the diffusion chamber vacuum test, total work time expected of 2 weeks
Vacuum tests	<ul style="list-style-type: none"> • Confirmation of good encloement for every assembly 	4 days on average per test, total of 16 work days
Pump tests	<ul style="list-style-type: none"> • Confirmation of good functioning of the pump 	1 week of work is estimated
Offline tests	<ul style="list-style-type: none"> • Target and pump coupling tests with the front end. • Calibration of the heating elements. • Source tests. 	Starting after full assembly of the target. Duration: 72 days

Task Name	Duration
LIEBE project	108 days
Target assembly	1 wk
Target vacuum test	16 days
Heating elements installation	1 wk
HEX test	1 wk
Pump tests	1 wk
Offline test	72 days

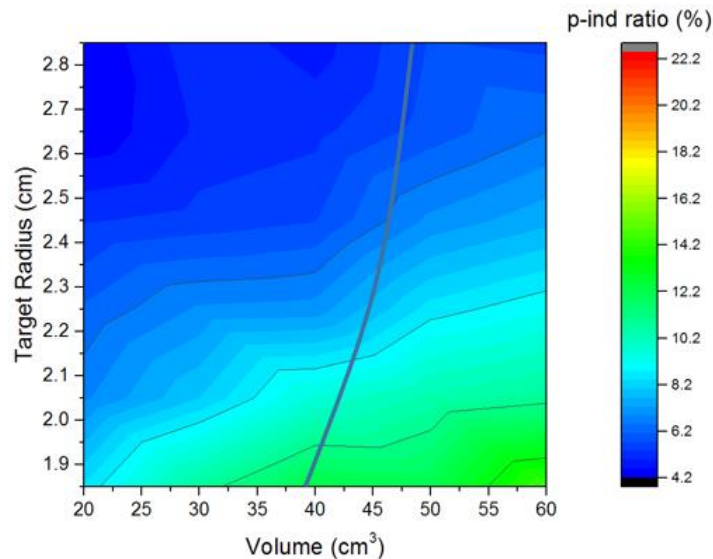
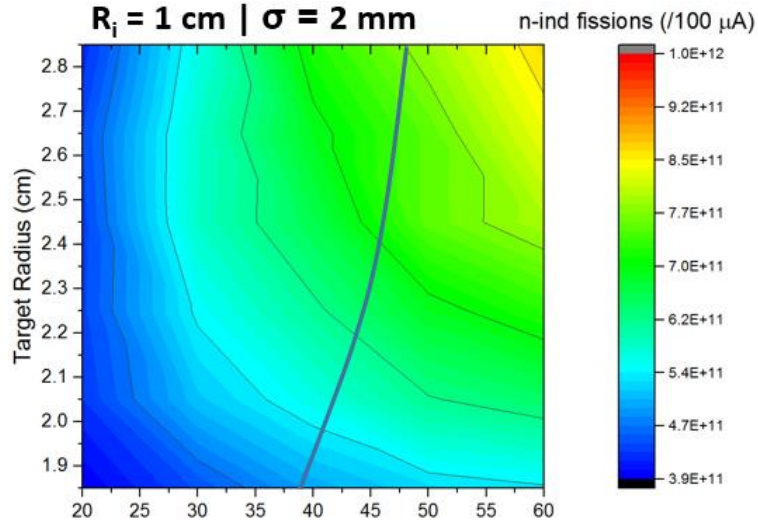
Offline tests starting mid-August

LIEBE target ready to go online mid-November

Slide: Ferran Boix Pamies

p2n converter

TRIUMF Converter collaboration



7.5 kW of deposited power in a 2 cm length tungsten cylinder

- Very challenging to cool
- ANSYS is being used to simulate the best solution to extract all the power

Offline experiments

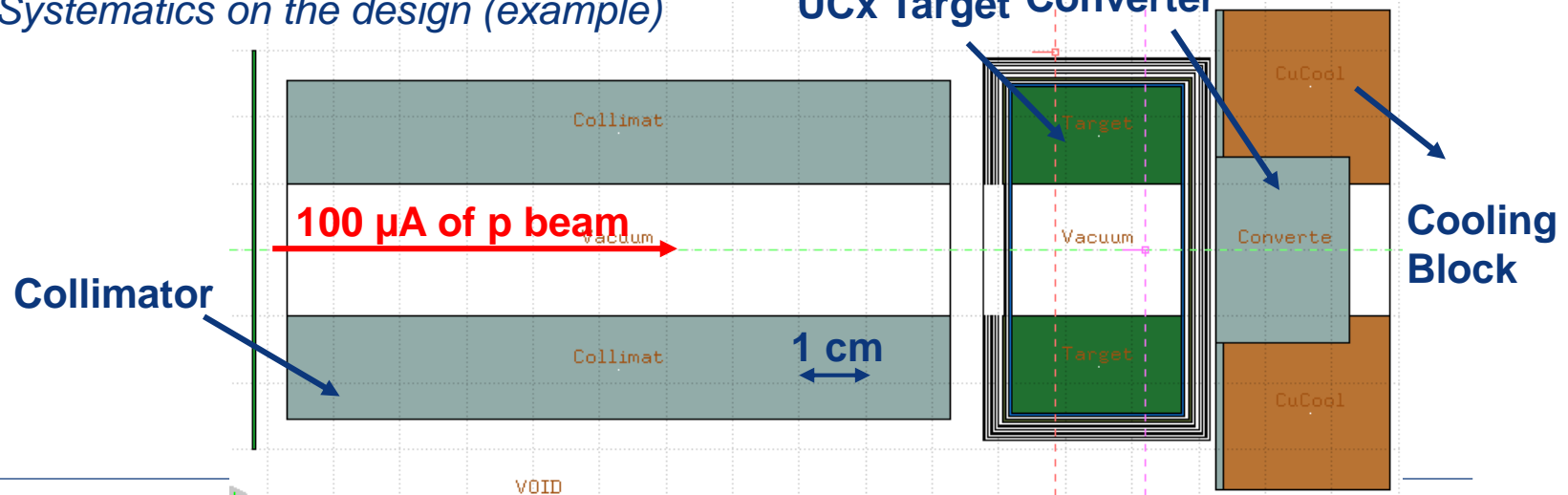
- test a large diameter target oven
- power deposition/cooling on tungsten and copper

Using FLUKA, systematic studies on the neutronics to minimize proton induced fissions and maximize neutron induced fissions are on going

Soon the same type of study will be done for ISOLDE

Systematics on the design (example)

UCx Target Converter



Nanolab

Option 1



1. Carburisation
2. Calibration
3. Hotte
4. Presse
5. Malaxeur
6. Boite a gants
7. Plan de travail

Option 2



1. carburisation
2. Calibration
3. Hotte
4. Presse
5. Malaxeur
6. Boite a gants
7. Plan de travail

- Funding secured
- Connection of ventilation foreseen in 2019

MWCNT Target production

CERN has forbidden any handling of nanomaterial

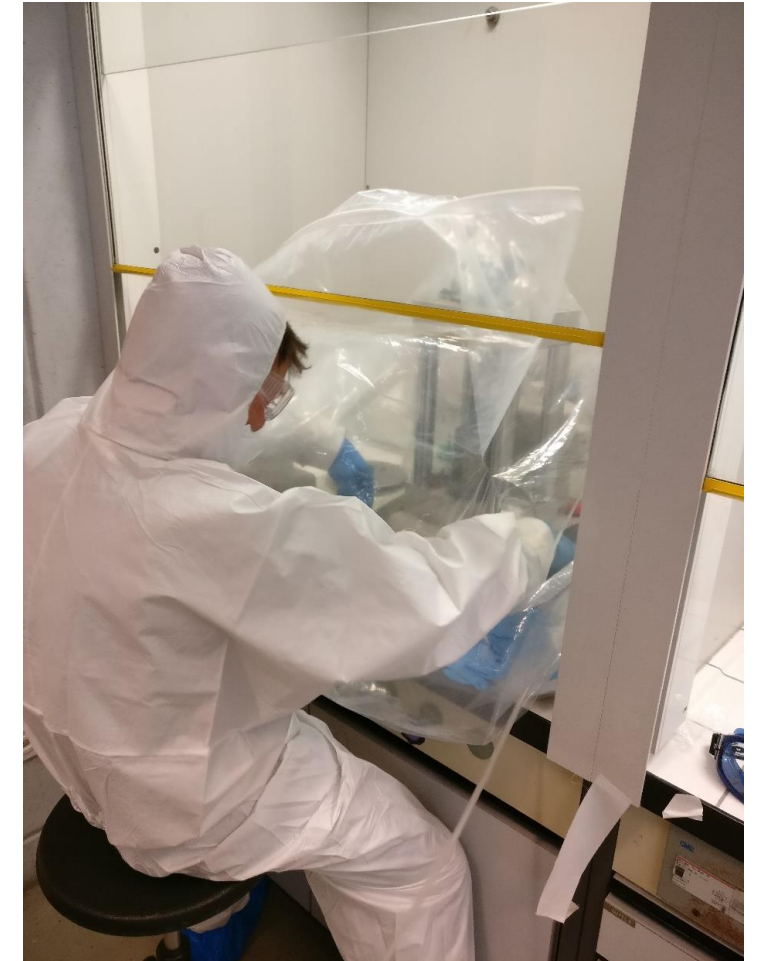
- Nanomaterials are requested at ISOLDE for physics (in this case MWCNT)

Powder technology laboratory in **EPFL**, has a class “nano 2”

- Accordingly to EPFL specifications “nano 3” is needed to handle MWCNT (need to have the nanomaterial sealed in glovesbox)

Glove’s bag was bought from Sigma Aldrich and used instead of Glove’s box.

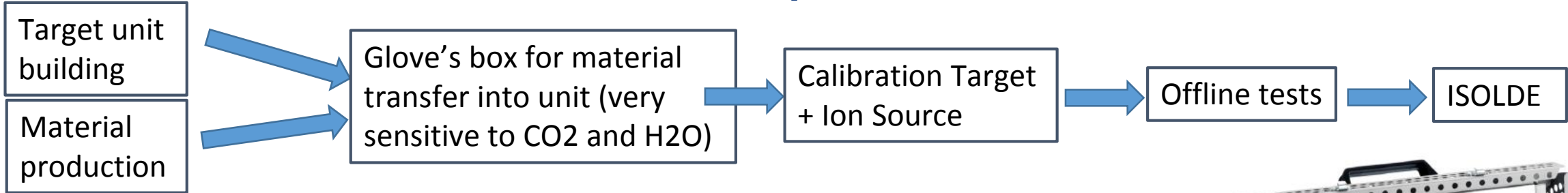
- Possible solution to lift the prohibition of handling nanomaterials



Successful press of full batch of MWCNT for ISOLDE target #606

J.P. Ramos, B. Crepieux, T. Stora, et al.

Dedicated oven for CaO production

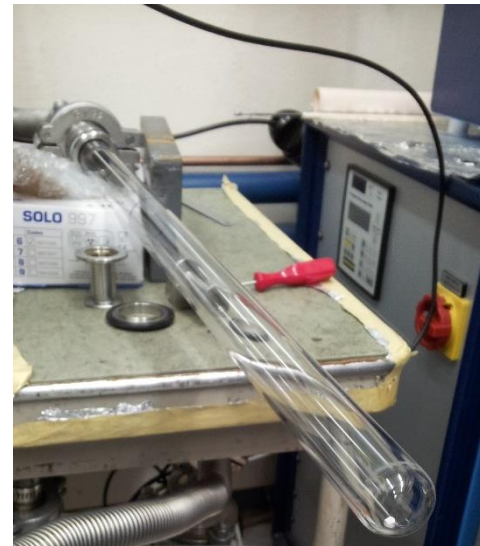


Current issues:

- Thermocouple positioning difficult (can't trust readout)
 - Use pyrometer but readout is difficult in the 700 – 800 °C range
- Thermal gradient in the container makes process much longer than should
- CaO production unit difficult to handle in gloves box

- Precise control of temperature
 - Temperature uniformity
- Higher quality CaO**

- Quartz tube easy to handle in glovesbox
- Production will be reduced to half-day.



Target Production Schedule

Collaboration Workspaces | Newsfeed | OneDrive | Sites | Sebastian Rothe

BROWSE | TASKS | LIST

Notebook | Documents | **Tasks** | Calendar | Site Contents | EDIT LINKS

Start 10/3 | April 2017 | May 2017 | June 2017 | Finish 16/6

#598 V...	#596 CaO VD7	#597 UC n Ta	#599 TIFoil...	#600 U...	#601 UC...	#604 UC n cq Ta
10/3 - 16/6	30/3 - 10/4	12/4 - 21/4	2/5 - 10/5	11/5 - 17, 17/5 - 24/5		26/5 - 16/6
	#595 U...		#606 MW...	#602 UC W	#603 UC n...	
	7/4 - 13/4		4/5 - 12/5	19/5 - 26/5	29/5 - 6/6	

+ new task or edit this list

All Tasks | Calendar | Completed | Find an item

Task Name	Due Date	MTF	OneNote	EDMS	Assigned To	Target Material	Ion Source	Transfer line	p2n conv
#594 RILIS	21 March	AQ000206	#594	EDMS	Michael Owen	empty container	MK1 - Ta	Ta	No
#595-UC n-Ta	13 April	AQ000214	#595	EDMS	Michael Owen	UC	MK1 - Ta	Ta	Yes
#596 CaO VD7	10 April	AQ000229	#596	EDMS	Michael Owen	CaO	VD7		No
#597-UC n-Ta	21 April	AQ000222	#597	EDMS	Bernard Crepieux	UC	MK1 - Ta	Ta	Yes

Published in dedicated website:

cern.ch/isolde-targets

point of entry for documentation
(login required)



ENGINEERING
DEPARTMENT